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Incorporating performance reference compounds in retractable/reusable solid phase microextraction fiber for passive sampling of hydrophobic organic contaminants in water

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ABSTRACT

Solid phase microextraction (SPME) has been used to measure aqueous-phase hydrophobic organic chemicals (HOCs) in equilibrium passive sampling mode for over two decades. However, determination of the extent of equilibrium has not been well-established for the retractable/reusable SPME sampler (RR-SPME), especially in the field applications. The goal of this study was to establish a method regarding to sampler preparation and data processing to characterize the ex-tent of equilibrium of HOCs on the RR-SPME (100-μm thickness of polydimethylsiloxane (PDMS) coating) by incorporating performance reference compounds (PRCs). A fast (4 h) PRC loading protocol was identified with using a ternary solvent mixture (i.e., acetone-methanol-water mixture (4:4:2, v/v)) to accommodate diverse carrier solvents of the PRCs. The isotropy of the RR-SPME was validated by a paired, co-exposure approach with 12 different PRCs. The aging factors measured with the co-exposure method approximately equal to one, indicating the isotropic behavior was not changed after storage at 15 °C and −20 °C for 28 days. As a method demonstration, the PRC-loaded RR-SPME samplers were deployed in the ocean off Santa Barbara, CA (USA) for 35 days. The PRCs approaching the extents of equi-librium ranged from 20 ± 15.5 % to 96.5 ± 1.5 % and showed a declining trend along with log KOW increase. A generic equation relationship was deduced based on a correlation relationship of desorption rate constant (k2) and log KOW to ex-trapolate non-equilibrium correction factor from the PRCs to the HOCs. The merit of the present study is manifested by its theory and implement to enable the RR-SPME passive sampler to be utilized in environmental monitoring.